

B-Type Natriuretic Peptide and Impedance Cardiography Testing at the Time of Routine Echocardiography Predict Subsequent Heart Failure Events

Luis R. Castellanos MD¹, Vikas Bhalla MD¹, Susan Isakson¹, Meenakshi A Bhalla MD¹, Jeannette P. Lin MD¹, Paul Clopton MS¹, Nancy Gardetto NP MSN¹, Max Hoshino BS¹, Albert Chiu BS¹, Robert Fitzgerald PhD², Alan S Maisel MD¹, FACC

¹Cardiology Division, UCSD/VASDHS, San Diego, CA, United States, 92161 and ²Pathology, VASDHS, San Diego, CA, United States, 92161

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Introduction

Heart failure (HF) is a major cause of morbidity and mortality among all adults. It is the most frequent cause of hospitalizations in the elderly. Thirty eight billion dollars are spent annually to treat heart failure:

- 900,000 hospitalizations/year
- 250,000 deaths each year

We designed this study to determine if the combination of BNP (Bayer Centaur, Tarrytown, NY) and ICG (BioZ[®], CardioDynamics, San Diego, CA) parameters could be used to risk stratify and predict HF-related adverse events in patients referred for routine echocardiography.

Methods

The University of California San Diego Institutional Review Board approved this study and 331 patients referred for an outpatient echocardiogram were enrolled. All measured values (ICG, echocardiography, hemodynamic parameters) and blood draws were performed within an hour of each other. Patients in whom echocardiography was done to either rule-out a cardiac source of a stroke or to rule-out endocarditis were excluded.

Echocardiogram Classifications

Experienced cardiologists who were blinded to the BNP and ICG results interpreted all echocardiograms performed by certified sonographers.

HF Related Events – All Patients were followed for HF-related events after the initial BNP level measurement, echocardiogram and ICG were taken. The median follow-up time was 302 (165-365) days. For each enrolled patient, the medical record was reviewed by a trained licensed physician for any emergency department visit or hospital admission that included HF as the primary diagnosis.

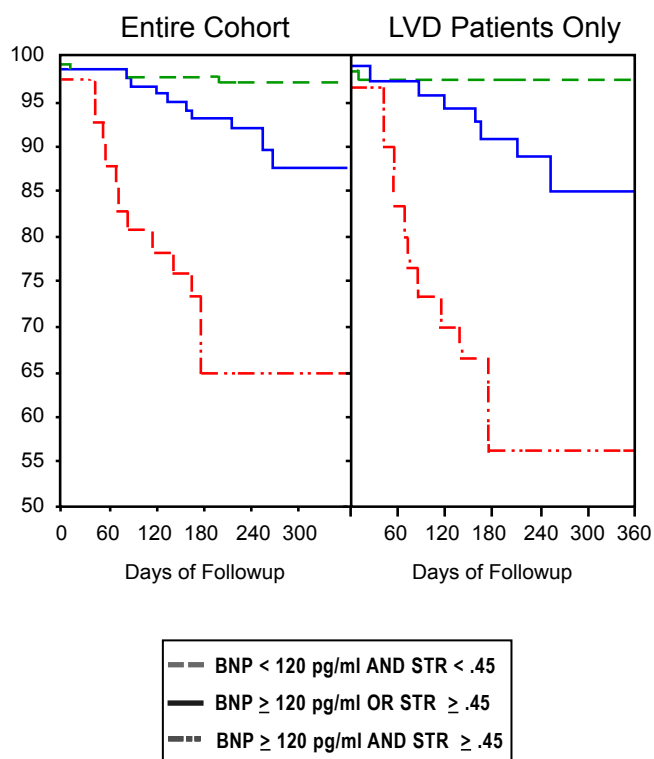
If a patient had more than one HF-related event, only the earliest event was counted. The reviewing physician was blinded to BNP, ICG parameters, and echocardiographic results. Cardiac-related deaths were determined based on documented physician's death note.

Results

Echocardiography, BNP, and ICG data were collected in 331 patients. A total 321 (97%) were male, 269 (82%) Caucasian, mean age 66.3 + 12.5 years. Sixty-six percent had a history of hypertension, 22% were obese, 38% had a history of CAD, 18% had a past MI, 54% had hyperlipidemia and 31% had diabetes. LV dysfunction (systolic or diastolic by echocardiography) was present in 53% of patients.

Univariate and subsequent multivariate analysis showed BNP and systolic time ratio (STR) by ICG to be the strongest predictors of future HF related adverse events irrespective of whether LVD was present. Combining STR and BNP testing had better prognostic value than either alone. Patients with the combination of BNP greater than 120 pg/ml and STR greater than 0.45 had a low event-free survival (55-65%). A BNP less than 120 pg/ml combined with a STR less than 0.45 had excellent negative predictive value (94-99%) in precluding future HF-related events (figure 1).

Figure 1. Kaplan Meier event survival curves according to combinations of BNP and STR for the entire cohort and patients with LVD.



Conclusions

- BNP and impedance cardiography are useful tools to identify patients at risk for heart failure-related events.
- BNP and STR combined are better predictors of heart failure-related events at 180 and 360 days in patients with either suspected or established LV dysfunction.
- BNP < 120 pg/ml and STR < .45 had an excellent negative predictive value (94-99%) in precluding future HF-related events.
- BNP > 120 pg/ml and STR > .45 had a low event-free survival (55-65%).